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FINANCIAL DEPENDENCE PATTERNS AMONG ARAB BANKING SECTORS IN THE AFTERMATH OF THE 2007 GLOBAL FINANCIAL CRISIS

Prepared by

Amir Armanious*

United Nations
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* Department of Applied Finance and Actuarial Studies, Faculty of Business and Economics, Macquarie University, email: Amir.Armanious@mq.edu.au.

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Abstract

The global financial crisis of 2007 (GFC) has brought home the urgent need for a thorough assessment of the dependence and interaction among banking sectors, from which most of the trouble originated. It is generally accepted that the degree of asset dependence is a key to realizing the benefits from financial integration (Bai and Green 2010). It is important to note that deepening bank integration contributes to greater systemic risk which is results in financial instability and financial fragility with banks becoming too-interconnected-to-fail. Interestingly, banking sectors in the Arab economies are classified with a high concentration ratio which attributes to increases in systemic risk as banks are too-big-to-fail. This paper's aim is to determine the level of integration, dependence and financial interconnectedness in Arab banking sectors in comparison with the U.S. and EU including UK, Germany, France, Spain and Italy for the period 2001-2016. We examine a variety of banking sectors' dependence and interconnectedness must be conducted before examining the degree of dependence and interconnectedness between each bank in different countries. We utilise three models in determining dependence, financial integration and interconnectedness in Arab banking sectors to identify the complete dimensions of transmitting shocks and integrations. The methods includes Time-varying Gaussian Copula of Patton (2012a), Delta Conditional Value-at-Risk (ΔCoVaR) of Adrian and Brunnermeier (2011), and Granger-causality networks of Billio, Getmansky, Lo and Pelizzon (2010).

Keywords: Banking Integration, Financial Liberalisation, Systemic Risk, Copula, CoVaR, Grang Causality Network, SIFIs, Too Big To Fall, Too Interconnected To Fall, and Risk Spillover.

1 Introduction

Generally financial integration and specifically banking integration have been greatly focused over recent decades[1]. There are an abundance of economic benefits derived from integration, such as enhanced efficiency from greater growth and competition. Integrated markets are more specialised against segmented markets and benefit all consumers via reduced intermediation and transaction costs (Berger 2003). Financial integration generates a diversity of perks such as the transfer of technology (Romer 1993), enhancing productivity (Claessens, Demirguc-Kunt and Huizinga 2001; Turner 2006; Gelos and Roldos 2002), foreign direct investment (Goldberg 2007), institutional development (Calomiris and Powell 2001), economic growth (Borensztein DeGregorio, and Lee 1998; Levine, Loayza and Beck 2000; Rajan and Zingalas 1998) and wage spill-overs (Crystal, Dages and Goldberg 2001).

Greater financial integration initiates increased competition and distributes financial access to inadequately serviced households and firms. This lowers financial restrictions impeding investment and consumption (Pongsaparn and Unteroberdoerster, 2011). Another effect is that financial integrating promotes investment. As Nabar and Syed (2010) stated, improving financing availability by 10 percent would enhance the rates of investment by small sized firms, medium size firms and service sector operatives by 2 percent. Consumption wise, increasing opportunities of financial services to households gives an overall surge in consumption (Jain-Chandra and Chamon 2011). In regards of allocative efficiency and economic diversification, cross-border banking usually guarantees productive capital is distributed to the most efficient businesses, thus enhancing net economic performance. Subsequently, this lowers risk from investment risk mispricing (Gonzales-Paramo and Manuel 2010).

Integrating the Arab banking market will immensely benefit its region. Initially the integrated banking sector will increase the customer base and generate opportunities to lower banking cost via enhanced competition, gaining economies of scale and building efficiency. Banks in the Arab region will have greater access to savings in their network and productively invest these funds to improve total factor productivity and increasing growth. Ultimately, the economy's real output growth is affected by the banking system's stability (Monnin and Jokipii 2010). In addition, integrating the banking market with boost the Arab banking industry's stability. The rise of regionally competitive banks and upgrades in financial infrastructure will definitely shape the banking sector to be stronger and effective at reacting swiftly to external shocks. This is likely to gather more collaboration amongst individual countries to defend against possible economic stability risks.

However banking integration also spreads risk by risk sharing in order to enhance the financial system's flexibility and subsequently its strength in enduring economic shocks. These perks are incurred at the expense of shock transmissions, business cycle co-movements, systemic risk and financial crises (Neumeyer and Perri 2005; Morgan, Strahan, and Rime 2004; Morgan and Strahan 2004). Through methods such as securitisation and derivatives, integrated banks can strengthen their ability to transmit shocks internationally and create more integrated regional and global business cycles. The notion of globalising banks is tied with financial linkages being the prevailing passages of international shock transmissions (Goldberg 2002).

It is paramount to construct an infrastructure for the region's financial intermediation needs in order to enhance regionalism within the Arab banking sector. The level of banking integration equates to the degree of the region's financial system being exposed to the bank's cross-border

[1] There are various forms of banking integration and interconnectedness including cross-border flows, cross-border transactions, international ownership of banks, subsidiaries of parent banks, derivatives use and securitisation.

portfolios. Subsequently, greater bank integration in Arab regions will be a difficulty for Arab policy makers to handle.

To advance the integration of banking markets, Arab policy makers must cover against possible threats. The entry of foreign banks could introduce obstacles encountered in their homeland to spill over as a risk to the domestic banking market. To prevent such banking integration negativities, prudential requirements and regulatory frameworks should be harmonised and designed flexible with international standards as well as information used by supervisors in both home and host countries[2].

The freedom to perform cross-border transactions comes with risk as it may encourage new foreign entrants to conduct speculative activities that will raise the capital inflow volatility in a certain member state, thus destabilising the economy. Therefore, individual member states must initially confirm the essential preconditions for capital account liberalisation and the fundamental safeguards[3]. With national supervisors cooperating and common interests identified, stability concerns may be alleviated. Such collaboration will need the setting of new regional arrangements to carry out surveillance and facilitate information as collective counters to emergencies prompted by external shocks.

With cross-border banking integration, there is an inevitable potential for foreign banks to completely control the domestic banking market. Numerous national supervisors believe that their domestic banking market's stability would be endangered if foreign competitors were to replace domestic participants. This threat urges for specific preconditions to entry liberalisation to be established first and entry being slowly liberalised as preconditions are satisfied. For instance, member states with underdeveloped banking institutions are permitted to liberalise entry of foreign banks to its domestic market more gradually.

Integrating banks can affect systemic risk in the long run due to the banking system's habit persistence. Habit-persistence is typical in bank lending behaviour due to incurring high switching and information costs. Acquiring clients' proprietary information possibly unavailable to other banks can provide banks with a competitive advantage. The occurrence of habit-persistence is linked the increasing risks faced by banks during times economic expansion periods and transforms into systemic risk when a macroeconomic shock or liquidity crunch grazes the country. Effects in the long run can arise from changing bank lending behaviours encouraged by new regulations, macroeconomic circumstances of information asymmetries. The change effect may not occur instantly, but rather accrue over time.

Despite empirical studies on systemic risk have increased in recent times (Adrian and Brunnermeier 2011; Acharya et al. 2010; Acharya, Engle and Richardson 2012), only a few discuss the bond of banking interconnectedness with systemic risk. Research has identified bank integration increases with the risk of cross-border systemic risk (Demirguc-Kunt and Detragiache 1998; De Nicolo and Kwast 2002; Mihaljek 2008).

Financial integration still harbours possible risks, regardless of its perks. Due to the global financial crisis, developing the financial sector poses uncertainties if done without enough regulatory structure. To effectively integrate all banks, it is paramount to harmonise banking regulations, oversee practises and adhere to Basel III in terms of capital adequacy. The

[2] Thus, Basel III will become an essential component as financial integration would require pairing with financial regulatory harmonisation.

[3] There is a long history of academic work on the proper role of central banks in bank supervision. See, for example, Blinder (2010); Boyer and Ponce (2010); European Central Bank (2001); Goodhart (2000); and Peek, Rosengren, and Tootell (1999).

sequential procedures include liberating trade in financial services and eliminating barriers to financial sector investment[4].

The goal of this paper is to measure the degree of integration, dependence and financial interconnectedness among banking sectors in the Arab region. We conduct two types of analysis in this paper. We first analyse the dependence and interconnectedness among the various banking sectors then we analyse the level of dependence and degree of interconnectedness among the different banks within each country. In order to capture the overall dimensions of integration and shock transmissions, the paper applies three models to measure financial integration, dependence and interconnectedness among banking sectors in the Arab region. These measures are Time-varying Gaussian Copula of Patton (2012a), Granger-causality networks of Billio, Getmansky, Lo and Pelizzon (2010), and Delta Conditional Value-at-Risk ($\Delta CoVaR$) of Adrian and Brunnermeier (2011).

The remainder of the paper is organized as follows. Section 2 provides a review of literature of banking integration and systemic risk measures. Section 3 proposes a methodological analysis of Copula dependence, Delta $CoVaR$ and granger causality. In Section 4, we describe the data and summary statistics. Section 5 presents the main empirical findings of the dependence between Arab banking sectors and both U.S. and EU banking sectors. Also, discusses the marginal contributions of financial institutions to systemic risk during the sub-period analysis (overall period, pre-crisis, crisis and after post-crisis). Section 6 summarizes and concludes for policy implications.

2 Literature Review on Banking Integration and Systemic Risk

There is intensive literature on financial integration and limited research on banking integration because of the narrow availability of data, markets are classified to be minor and generally low liquidity impact the some measures' reliability. Apparently, shallow markets have greater noise and are less dependable with data being unavailable for long time periods. Due to the data's low quality, analysis of results must be conducted with caution.

Markets are considered integrated when products and services of similar nature are exchanged at the same price (Weill 2009; Casu and Girardone 2010)[5]. Multiple studies have researched financial integration in the EU (Adam et al. 2002; Baele et al. 2004). Financial integration is believed to build economic growth by eliminating trade barriers and enabling more effective capital allocation (Baele et al., 2004), despite empirical research being incomplete on the issue (Edison et al. 2002). For nations with one currency, its monetary policy's effectiveness is affected by the level of financial integration as the financial system has a role in managing capital and transforming decisions on monetary policy into different interest rates and asset prices.

Formers studies on the use of copula dependence conducted by Longin and Solnik (2001), Ang and Chen (2002), Hu (2006), Bhatti and Nguyen (2012) and Basher, Nechi, and Zhu (2014), discovered asymmetric tail dependence in their researched markets, which indicates a greater joint possibility of market downturn or upturn. Asymmetric dependence also existed between the Japanese yen and the Deustche mark (Patton 2006b). Proof of financial contagion and coefficients have asymmetric tail dependence across huge international stock markets were

[4] Harmonising the regulatory system could be separated into six categories involved in (i) entry and licensing, (ii) capital stringency, (iii) supervision, (iv) empowering supervisors to take prompt corrective action, (v) restrict risk management procedures, and (vi) transparency.

[5] Significant differences in cost structures may result from heterogeneity in banking regulations such as entry requirements, capital charges, barriers to trade in financial services, taxation and many others.

found by Jondeau et al. (2007). Lately, gold and USD exchange rates contain proof of symmetric tail dependence (Reboredo 2013). Dependence amongst stock markets and commodities have been documented by Lopez (2013) to be time-varying, symmetrical and frequently reoccurring.

While integration of banks accelerates interconnectedness among banks, it broadens the vulnerability the regional financial system at risk of financial contagion at a national level. Greater banking integration is commonly correlated with the banking sector's exposure to financial instability and negative shocks (Laeven and Valencia 2008). It is debated that integrating banks would aid in diminishing risks confronted by banks and improve the banking system's flexibility (Claessens, Demirguc-Kunt and Huizinga 2001). Contrastingly, strengthened financial ties in a high capital mobility world could raise the cross-border financial contagion risk via interconnectedness.

In relation to supervision of regional banking, Siregar (2013) believed that the banking sector is greatly interconnected both regionally and globally as local and regional banks have both heavily borrowed and issued loans towards the global banking system. The necessity of integrating supervisory agencies of financial markets is not a domestic matter anymore. Due to these banks' cross-border natured operations, regularly supervising these banks' domestic activities will not suffice in determining all the risk exposures.

The global financial crisis of 2007 had generated a domestic urgency to detailedly examine the banking sector's interactions and dependence, since its where majority of the disturbance begun. The level of asset dependence is believed to be fundamental in reaping financial integration benefits. (Samuelson 1967; Ibragimov, Jaffee, and Walden 2009; Shin 2009; Veldkamp and Van Nieuwerburgh 2010; Bai and Green 2010). Comprehending each banking sector's dependence is concerned by practitioners and scholars along with policy-makers and regulators who responsibilities involve securing a steady and strong financial system.

The recent crisis revived studies on how international financial integration and concomitant capital flows are determinants in worsening the banking system's vulnerability. This study has pinpointed the connection between financial crises and de facto financial integration[6]. There is evidence that ties banking crises with the aggregate shock of foreign liabilities in developed countries, but none in developing countries (Bonfiglioli, 2008). The probability of banking crises is strongly linked to the foreign debt liabilities stock in emerging economies as research on the latter reveals that a larger likelihood of crises is correlated with a bigger proportion of foreign liability debt (Joyce 2010; Ahrend and Goujard 2011). Contrasting, other studies have failed to connect the total external liabilities' portion of external debt and the likelihood emerging markets experiencing banking crises, despite being strongly correlated in high-income countries (Gourinchas and Obsfeld, 2012). However, recent studies is successfully connecting fast inflow growth (e.g. a boom) with a high possibility of crises. They also realise that the inflow types are influential as debt inflows are specifically concerning (Reinhart and Reinhart 2009; Furceri et al. 2011; Caballero 2012; Powell and Tavella 2012).

There is a relationship between systemic risk and macroeconomic health (Fecht, et al. 2012). A national slowdown affecting the bank's investment portfolio signifies that bank integration has failed. The bank is weakened against an unfavourable deposit rate and is exposed to higher vulnerability. The bank's offered deposit rate can be a proxy for the economy's real interest rate. Financial stability can be achieved by favourable economic growth and low inflation under a stable macroeconomic environment (Detragiache and Demirguc-Kunt 2005). Notably, systemic risk is substantially affected by the business cycle (Segoviano and Goodhait 2009;

[6] The literature tends to proxy de facto financial integration by the stock of foreign liabilities.

Wong and Fong 2011) as they impact consumer risk appetites as well as the central bank's monetary policy (Detragiache and Demirguc-Kunt 2005; Angeloni, et al. 2010) which affects asset prices. The factors subsequently affect the banks' exposure to risk and therefore can worsen or reduce the degree of systemic risk.

By utilising the bivariate GARCH constant conditional correlation model on the Bank of International Settlements' (BIS) confidential data on 36 country -pairs and covers during the Q4 1997 to Q1 2010 period, substantial empirical proof reveals cross-border systemic risk rises from deepening bank integration (Lim, Khong and Tan 2015). In a country of high real interest rates and unfavourable economic conditions, cross-border systemic risk tends to worsen. In addition, cross-border systemic risk is accrued over time due the habit-persistence within bank lending behaviour and transforms further later on. This means systemic risk is affected by bank integration in the long term.

Financial system interconnectedness means each participant is reliant upon each other. Rochet and Tirole (1996), Allen and Gale (2000) and Freixas (2004) had initially endeavoured to graph the connection between the integration of banks to financial instability or systemic risk. Fecht et al.'s (2012) new hypothetical model includes the endogeneity of inter-temporal bank lending behaviour in the integrating banks. It is ideal to integrate banks within a secured interbank market as it promotes banks to specialise and lowers the likelihood of individual bank failures. On the other hand, integrating banks in an unsecured interbank market incentivises banks to diversify while exacerbating systemic risk effects[7].

To comprehend how certain shocks affect each of the network's nodes, it is vital to know the network's varying levels of connectedness or position relative to it. Instinctively, a systemic shock is able to affect a node that is more highly connected. It is important to consider that the financial network can be both strong and weak based on its structure (Haldane 2009). Joining the global banking network may provide the country with convenient reach of international capital markets when in need and therefore give the same country resilience to varying shocks initiated by financial crises. Also, greater connectedness may be linked to greater capability to disperse economic shocks. Kali and Reyes (2010) discovered countries that a more integrated in the global trade network were better at softening the effects of financial shocks, like the Asian and Mexican Crises, whereas Callallero et al. (2009) found countries with banks more strongly tied to the global syndicated loans network before the global financial crisis were less impacted by the crisis.

As an existing financial integration proxy, Caballero (2012) used a networks statistics of banks involved in global interbank syndicated loans markets during the 1980 to 2007 period. He discovered that the average bank's integration level was a solid factor in banking crises occurring. Greater de facto integration is calculated by banks borrowings and the occurrence of crises being positively correlated. Greater de jure integration or capital account openness and the higher occurrence of crises is also positively correlated. Despite this, outcomes also reveal that prudential banking regulation (supervision) is a huge and essential determinant to lowering the occurrence of crises.

[7] See Allen and Babus (2009) for their recent examination on the theoretical studies of financial networks. For models of financial market contagion, find Anand et al. (2011) whereas Zawadowski (2012); Acemoglu et al. (2012), Acemoglu et al. (2011) and Blume et al. (2011) have examined relevant models of cascading effects. Use IMF (2009) to see network approach for systemic risk simulations.

3 Methodology

3.1 Copula Dependence

Embrechts et al. (2002) states that the convenient characteristics of linear correlation allow it to canonically calculate the link between stocks. With belief of constant correlation, previous studies used models that price stock jointly (Agmon 1972; Solnik 1974). Following research substantiates that co-movement in stock returns change over time (Brooks and DelNegro 2004; Forbes and Rigobon 2002; Kizys and Pierdzioch 2009). Due to linear correlation deficiencies, modelling time-varying stock dependence now generally use multivariate GARCH models as there is rising popularity in this study area (Syllignakis and Kouretas 2011; Gjika and Horvath 2013; Baumöhl and Lyócsa 2014; Kundu and Sarkar 2016). However, the multivariate GARCH method is restricted by belief of symmetric multivariate normal or Student-t distribution determining the innovations of returns (Patton 2006b; Garcia and Tsafack 2011). Therefore, this belief conflicts with empirics as the financial returns distributed containing tails heavier than ones characterised as normally distributed and dependent amongst stock returns are typically asymmetric and nonlinear (Embrechts et al. 2002).

The trends, patterns and co-movements in absolute and tail dependence of the Arab banking sectors are analysed overtime by the time-varying Gaussian Copula model. While financial returns typically show fat-tails, it is necessary to determine both the absolute dependence and dependence between tail events. Copula models are effective dependence measures as they are unaffected by ever-growing data transformation, therefore being scale invariant (Nelsen 2006). They also expose both asymmetric and serial dependence, an ordinary financial returns fact. It is substantiated that dependence across financial institutions naturally increases in financial turmoil while staying low in calm periods. Thus, the threat of contagious shocks easily expanding over integrated financial institutions remains possible.

In theory, copulas rationally explain the dependence structure across random variables across a range of variation, such as dependence being categorised as extreme or tail, linear or non-linear and symmetric and asymmetric. Furthermore, copula functions are constant to non-linear ever-growing data transformations and differ to traditional dependence methods like linear correlation (Embrechts et al. 2002).

The copula theory derives from Sklar's theorem which demonstrates that joint distributions with n-dimensions can be disintegrated into an n-dimensional copular and n marginal dimensions, thus connecting the dependence between variables. This means a variety of models can be used for marginal distributions and form valid multivariate distributions constant with this marginal and bypass the usual normality assumption.

Many bivariate copulas can identify different dependence patterns like Gaussian, Student-t, Clayton, Gumbel, rotated Gumbel, Symmetrized Joe-Clayton, etc. In order to model the Asian banking sector indices' joint distributions, three joint copulas will be employed including the Gaussian copula, the static Symmetrised Joe-Clayton and time-varying Joe-Clayton copulas.

Copula functions combine several univariate distributions into a singular multivariate distribution. Due to fat-tails, long-memory and conditional heteroscedasticity being proven qualities of financial time series, it is suitable to attain these characteristics via autoregressive (AR) or generalised autoregressive conditional heteroscedasticity (GARCH) models. Therefore, we can use AR(k)-GARCH(p,q) models as below:

$$_{it} = \mu_i + \sum_{i=1}^{k} \varphi_{i,k} \;\; _{it-k} + \varepsilon_{it} \qquad (1)$$

$$\varepsilon_{it} = \sigma_t z_{it}, z_{it} \sim SKT(\nu, \xi)$$

$$_{it}^{2} = \omega_i + \sum_{i=1}^{p} \alpha_{i,p} \; _{it-p}^{2} + \sum_{i=1}^{q} \beta_{,p} \; _{it-p}^{2} \quad (2)$$

Where X is the banking sector's log difference of the i^{th} at time t, the banking sector's real-valued discrete time stochastic process ε_{it} at time t, z_{it} being an unobservable random variable in the i.i.d. process, σ_t^2 being the conditional variance of ε_{it} with ω, α_1 and β_1 being the constant, ARCH parameter and GARCH parameter respectively. The order of autoregressive terms, ARCH terms and GARCH terms are denoted by subscripts k, p and q respectively. To evaluate marginal models, we accept z_{it} as the skewed-t distribution. Skewed-t distributions come with two shape parameters. One is the degree of freedom parameter, $\nu \in (2, \infty)$, that identifies tail thickness. The other is a skewness parameter, $\nu \in (2, \infty)$, which determines asymmetry degree in distribution. As $\nu \to \infty$, it becomes a normally skewed distribution, when $\xi = 0$, it forms the standard Student's t-distribution, and when $\nu \to \infty$ and $\xi = 0$, we get $N(0,1)$ (Patton 2012a,b).

In marginal models, u and ν are the standardised residuals' cumulative density functions. To determine the each margin's dependence structure, we use following copula function:

$$C(u, v) = \int_{-\infty}^{\Phi^{-1}(u)} \int_{-\infty}^{\Phi^{-1}(v)} \frac{1}{2\pi\sqrt{1-\rho^2}} exp\{-\frac{x^2 - 2\rho xy + y^2}{2(1-\rho^2)} dx.dy\} \quad (3)$$

$$C(u, v) = \Phi_\rho(\Phi^{-1}(u), \Phi^{-1}(v)), -1 \leq \rho \leq 1 \quad (4)$$

Φ signifies the standard normal's univariate cumulative distribution; Φ_ρ signifies the standard normal's bivariate cumulative distribution; and ρ represents the correlation coefficient amongst two random variables. Patton (2004), Patton (2006a), Patton (2006b), and Jondeau and Rockinger (2006) have contributed to the preceding research done on time-varying copula models. Bhatti and Nguyen (2012) discuss the typical time-varying copula model requirements is to develop dynamic equations for dependence parameters while managing a fixed structure for the copula's functional form. This becomes challenging when defining a forcing variable for the dependence parameter's evolution equation (Heinen and Valdesogo 2012). Patton's (2006b) formula is similarly modelled to the dynamic evolution of Gaussian copula parameters.

$$\rho = \wedge (\omega + \beta\rho_{-1} + \alpha \frac{1}{10} \sum_{j=1}^{10} [\Phi^{-1}(u_{t-j})\Phi^{-1}(v_{t-j})]) \quad (5)$$

The normalised form of inverse Fisher transformation (modified logistic transformation) is represented by $\wedge = \frac{1-e^{-x}}{1+e^{-x}}$ and pushes ρ to be between the intervals of (-1,1); u_t and v_t are the probability integral transformations (PIT) of the marginal.

The symmetrised Joe-Clayton copula is a revamped alternative of "BB7" copula of Joe (1997) (Patton 2006b). The Joe-Clayton copula's Laplace transformation is designed as:

$$C_C(u, v|\tau^U, \tau^L) = 1 - \{1 - ([1 - (1-u)^k]^{-\gamma} + [1 - (v)^k]^{-\gamma} - 1^{-1/y})\}^{1/k} \quad (6)$$

where $k = 1/log_2(2 - \tau^U)$, $\gamma = -1/log_2(\tau^L)$, and $\tau^U \epsilon (0,1)$, $\tau^L \epsilon (0,1)$

A distinct characteristic of the Joe-Clayton copula is its ability to determine both upper tail (τ^U) and lower tail (τ^L) tail dependence. The upper tail dependence is defined:

$$\tau^U = \lim_{\varepsilon \to 1} Pr[U > \varepsilon | V > \varepsilon] = \lim_{\varepsilon \to 1} Pr[V > \varepsilon | U > \varepsilon] = \lim_{\varepsilon \to 1} Pr \frac{(1 - 2\varepsilon + C(\varepsilon, \varepsilon))}{1 - \varepsilon} \quad (7)$$

Copula C reveals upper tail dependence if $\tau^U \in (0,1)$ and no upper tail dependence if $\tau^U = 0$ under the existence of an above limit. Similarly for lower tail dependences are defined as:

$$\tau^L = \lim_{\varepsilon \to 0} Pr[U \leq \varepsilon | V \leq \varepsilon] = \lim_{\varepsilon \to 0} Pr[V \leq \varepsilon | U \leq \varepsilon] = \lim_{\varepsilon \to 0} Pr \frac{C(\varepsilon, \varepsilon)}{\varepsilon} \tag{8}$$

Copula C reveals lower tail dependence if $\tau^L \in (0,1)$ and no lower tail dependence if $\tau^L = 0$ under the existence of an above limit.

Despite identifying the distribution's upper and lower tails, the Joe-Clayton copula's functional form exerts some levels of asymmetry even if the two tail dependence are identical. To counter this, Patton (2006b) has developed the Symmetrised Joe-Clayton (SJC) which enables measures of tail dependence to find the existence or absence of asymmetry. The SJC is represented as:

$$C_{JC}(u, v | \tau^U, \tau^L) = 0.5[C_C(u, v | \tau^U, \tau^L) + C_C(1-u, 1-v | \tau^U, \tau^L) + u + v - 1] \tag{9}$$

When $\tau^U = \tau^L$, the SJC becomes symmetric. It requirements does not impose the variables to have symmetric dependence.

The upper and lower tail dependence parameters evolving over time are regarded by Patton (2006b) as:

$$\tau_t^U = \wedge (\omega U + \beta \tau_{t-1}^U + \alpha_U \frac{1}{10} \sum_{j=1}^{10} |u_{t-j} - v_{t-j}|) \tag{10}$$

$$\tau_t^U = \wedge (\omega L + \beta \tau_{t-1}^L + \alpha_L \frac{1}{10} \sum_{j=1}^{10} |u_{t-j} - v_{t-j}|) \tag{11}$$

The logistic transformation being $\wedge = (1 + e^{-x})^{-1}$ contains the parameters (τ^U, τ^L) in between the interval (0,1). For joint distribution, time vary parameters are the upper and lower tail dependence.

Transforming τ_t and τ_t^L is presented as a restricted ARMA (1,10) process with autoregressive terms $\beta \tau_{t-1}^U$ and $\beta \tau_{t-1}^L$ to maintain perseverance whereas forcing variables $\frac{1}{\alpha_U} \frac{1}{10} \sum_{j=1}^{10} |u_{t-j} - v_{t-j}|$, maintain dependence variations. The forcing variable, known as the absolute difference of u_t and v_t in regards to their past 10 observations, is conversely connected to dependence as; a perfect positive dependence is zero, under dependence is equivalent to $\frac{1}{3}$ and under perfect negative dependence is $\frac{1}{2}$ (Patton 2006b).

3.2 Time-varying Delta CoVaR

The conditional Value-at-Risk (CoVaR) was made to examine how a financial institution could transmit risk to a different financial institution or to the entire financial system (Adrian and Brunnermeier, 2011). This technique was derived from the Value-at-Risk, represented as VaR(q) (Jorion 2007)[8]. Mathematically speaking, the Value-at-Risk signifies a (1-q) confidence level, related to the q-quantile's calculated distributions of gains and losses over a targeted period.

The CoVaR method is widely flexible in explaining risks spilling over on individual institutions or a collective of institutions and seems specifically reliable to find systemic risk factors. $CoVaR_q^{j|i}$ is an institution or financial system j's VaR_q^j, under circumstances of $C(X^i)$ affecting an institution i, which is emerges as the institution's return (X^i) being equal to its degree of VaR for a q^{th} quantile (i.e. $X^i = VaR_q^j$) (Adrian and Brunnermeier 2011). $CoVaR_q^{j|i}$ is represented as the q^{th} quantile of the conditional probability distribution of j returns:

$$\Pr\left(X^j \leq CoVaR_q^{j|i} | X^i = VaR_q^j\right) = q \qquad (12)$$

ΔCoVaR is the discrepancy between the financial system j's CoVaR when financial institution i is under distress such as when adverse VaR levels (e.g. 1%) are reached, and the said financial system's CoVaR is circumstantial to the same institution's normal state such as when institution reaches its median state (e.g. 50%).

$$\Delta CoVaR_q^{j|i} = CoVaR_q^{j|X^i = VaR_q^i} - CoVaR_q^{j|X^i = Median^i} \qquad (13)$$

The CoVaR method supplies to the financial institution's marginal contribution to the financial system's risk if the financial institution is operating under stressful conditions, not normal. In Eqs. (12) and (13), calculating the relevant VaR_q^i and its $\Delta CoVaR_q^{j|i}$[9] could represent a firm, a portfolio of firms, a sector or even the whole financial system[10]. Quantile regressions can measure linkages between a group of independent variables and particular quantiles of dependent variables (Koenker and Basset 1978) [11].

Individual banking sector's daily market returns $(X_t^i(q))$ are calculated with a q^{th} quantile regression, with the 5% quantile to signify a distress situation:

$$X_t^i(q) = \alpha_q^i + \gamma^i M_{-1} + \varepsilon^i{}_t \qquad (14)$$

α_q^i denotes the constant while M_{-1} denotes the vector of lagged state variables (refer to Section 4). Being independent of M_{-1}, the error term ε_t^i is believed to be i.i.d and have to unit variance

[8] VaR is the most popular measure of risk used by professionals to evaluate market risk. Intuitively, the VaR(q) is the worst loss over a target horizon that will not be exceeded with a given level of confidence 1-q

[9] Adrian and Brunnermeier (2011) use the growth rates of market valued total assets for an individual institution, which are defined as a function of lagged state variables while this paper uses daily market return of each banking sector.

[10] $CoVaR_q^{sys|i}$ is defined as the VaR_q^{sys} of the whole system conditional on an event $C(X^i)$ affecting a financial sector i (the return for this financial sector (X^i) being equal to its level of VaR for a q^{th} quantile). Consequently, $\Delta CoVaR_q^{sys|i}$ is defined as the difference between the CoVaR of the whole system conditional on distress affecting a given financial sector i and the CoVaR of the same system conditional on a normal situation for the financial sector of interest i.

[11] In the empirical results, the $\Delta CoVaRs$ are negative because they are computed from the worst 1% returns of the banking sector. Along these lines, the sector of the financial system with the largest $\Delta CoVaR$ absolute value is the sector that contributes relatively the most to systemic risk during periods of distress.

with zero mean.. For this instance, returns under the 5% quantile are acquired from using the quantile regression framework.

The estimated 5% VaR for each banking sector is then calculated using all the previous step's variables:

$$VaR_t^i(q) = \hat{}_q^i + \hat{} M_{-1}^i \qquad (15)$$

From Eq. (14) we acquire $\hat{}_q^i$ and $\hat{}_q^i$ Following these steps eliminates the equity market return variable's effect on VaR predictions without changing other variable's coefficient variables that was considered in the estimation procedure's first steps. This means we can ignore the equity market's state while analysing a financial sector's intrinsic risk. While matching the main objective, we can measure the distressing effects of systemic risks within the financial sector.

Under the q^{th} or rather 5% quantile regression framework, we measure the returns of the system:

$$X_t^{sys}(q) = \alpha_q^{sys|i} + \beta_q^{sys|i} X^i + \gamma_q^{sys|i} M_{t-1}^{sys} + \varepsilon_t^{sys|i} \qquad (16)$$

With the returns of stock market indices of the system of interest (X_t^{sys}), we can estimate macro-economic mechanisms. According to Eq. (16), $\alpha_q^{sys|i}$ denotes the constant, $X\dot{t}$ is the banking sector index's returns, the error term is represented by $\varepsilon_t^{sys|i}$. While Eq. (14) portrays M_{t-1}^{sys} as the same vector of lagged state variables. Quantiles regressions are still used to find the system's 1% quantiles of returns.

The system's estimated CoVaR or otherwise the system's VaR which is situational to an event of distress under insurance, banking and other financial services sectors (depiced by 5% quantile regressions acquired in preceding steps) is then calculated. We then use Eq. (15) to generate $VaR_t^i(1\%)$ and place it in Eq. (18) with all of Eq. (16)'s explanatory variables:

$$CoVaR_t^{sys|i}(q) = \hat{}_q^{sys|i} + \beta^{sys|i}_q VaR^i(q) + \hat{}_q^{sys|i} M^{sys}_{t-1} \qquad (17)$$

From Eq. (16) we get $\hat{}_q^{sys|i}$, $\beta^{sys|i}_q$ and $\hat{}_q^{sys|i}$

The disparity in between the estimated CoVaR at 5% and 50% quantiles can be used to calculate the $\Delta CoVaR$. The 50% quantile CoVaR explains an event of median-state conditions[12]. Ultimately the $\Delta CoVaR$ is a presentation of the banking sector's marginal contribution to systemic risk:

$$\Delta CoVaR_t^{sys|i}(q) = CoVaR_t^{sys|i}(5\%) - CoVaR_t^{sys|i}(50\%) \qquad (18)$$

[12] To test the robustness of our results, we tested different levels of quantile both for the so-called normal-state (i.e. 40%, 45%, 55% and 60% quantile additionally to the 50% quantile) and the distress-state (i.e. 1% quantile additionally to the 1% quantile). Results available upon request.

3.3 Granger Causality Network

To estimate the interconnectedness of financial institutions along with all of the financial system's systemic risk, statistics from granger-causality tests as well as other techniques have been proposed (Billio, Getmansky, Lo and Pelizzon, 2010). Derived from the monthly return indices by hedge funds, broker/dealers, insurance companies and banks, these measures reveal granger-causality networks to be really active and are highly interconnected at times before systemic shocks. Granger-causality tests were customised to determine the direction and interconnectedness in the bonds of financial institutions within the financial system. If past X values possess information that is useful in anticipating Y above the information solely inherent in past Y values, then Y is Granger-caused by X. This granger-causality equation is expressed as:

$$_t = \sum_{j=1}^{m} {}_j \, x_{t-j} + \sum_{j=1}^{m} {}_j \, x_{t-j} + \epsilon_t \quad (19) \; {}_t$$

$$= \sum_{j=1}^{m} {}_j \, x_{t-j} + \sum_{j=1}^{m} {}_j \, x_{t-j} + \omega_t \quad (20)$$

The max lag length being m. Two uncorrelated white noise processes being ϵ_t and ω_t. If b is not equal to zero, then Y affects X. Likewise, when c is different from zero then Y is caused by X on the condition that the p-value is below 5%. When both conditions are held true, then the two time series forms a feedback connection.

Analytically, the experiment is conducted on the indices of monthly returns by the banks, hedge funds, broker/dealers and insurance companies. Insight from this research is based on the Eurozone's financial institutions' return indices. Similarly, we have estimated a collection of banking indices from the Arab, Euro and U.S. regions from the past 36 monthly returns in a quarterly basis from 2000 to 2014. The dynamic causality index (DCI) is calculate each interval where:

$$DCI^t = \frac{number\ of\ casual\ relationships\ in\ window}{\sout{total\ possible\ number\ of\ casual\ relatinships}} \quad (21)$$

The DCI degree precisely correlates to the financial system's level of interconnectedness. Therefore, a financial system being more interconnected would have a greater DCI value. Furthermore, a single institution Granger-causes at both 1% and 10% were used to estimate several financial institutions. Instead of just the top 25 institutions, this paper has concentrated on both small and large institutions.

On a monthly interval with the past returns of 36 months, the relationship's direction and interconnectedness amongst banks within the Arab financial system have been determined by Granger-causality tests. Since the extent of the dynamic causality index reveals the financial system's interconnectedness, the DCI can be calculated for each interval. Therefore, a greater DCI value means a more highly interconnected system. Additionally, a single institution Granger-causes at both 1% and 10% were used to estimate several financial institutions.

4 Data

For the Arab region, the sample comprises of publicly listed banks selected from the 11 Arab countries, namely Bahrain, Egypt, Jordan, Kuwait, Lebanon, Morocco, Oman, Qatar, Saudi Arabia, Tunisia, and UAE.[13] Weighted average market capitalisation is used to calculate each Arab country's banking index[14]. 116 listed Arab banks are used in the sample[15]. Also, banking indices from first world countries such as US (Dow Jones U.S. Banks index), Eurozone (EURO STOXX Banks index)[16] and big European economies UK, Germany, France, Spain and Italy are analysed to determine the level of financial integration convergence[17].

Table 1 shows that UAE has the highest number of listed banks of 19 banks followed by Bahrain, Egypt and Saudi Arabia of 13, 12, and 12 listed banks respectively while Lebanon and Morocco has the lowest number of listed banks of 6 banks each. Bahrain has the highest total assets to GDP ratio of 394.10% followed by Jordon, Lebanon and Kuwait of 238.60%, 231.40%, and 205.60% respectively while Egypt has the lowest total assets to GDP ratio of 23.70%. Lebanon has the highest deposits to total assets ratio of 81.29% followed by Egypt, Saudi Arabia and Jordon of 80.49%, 77.40%, and 70.45% respectively while Bahrain has the lowest deposits to total assets ratio of 37.74%. Jordon has the highest non-performing loans ratio of 7.3% followed by Morocco, Bahrain and Egypt of 6.73%, 6.19%, and 5.49% respectively while Saudi Arabia has the lowest deposits to total assets ratio of 1.06%.

Table 1: Banking Sectors Characteristics in the Arab Region (2015)

Country	No. of Listed Banks	Total Assets to GDP (%)	Deposits to Total Assets (%)	Non-performing Loans (%)
Bahrain	13	394.1%	37.74	6.19
Egypt	12	23.7%	80.49	5.49
Jordan	11	238.6%	70.45	7.30
Kuwait	10	205.6%	62.46	2.90
Lebanon	6	231.4%	81.29	3.92
Morocco	6	118.4%	66.91	6.73
Oman	7	90.2%	63.78	2.86
Qatar	9	179.5%	63.68	2.15
Saudi Arabia	12	89.5%	77.40	1.06
Tunisia	11	77.8%	67.98	5.30
UAE	19	152.7%	69.10	4.60

Empirical research is conducted between the January 3, 2001 to December 31, 2016 period. This timeline is appropriate in examining the Arab banking sector's degree of connectedness and integration levels as it involves three financial crises (2001 dotcom bubble, 2007 global financial crisis and 2009 European sovereign debt crisis) along with the Arab spring of 2011. This period is divided into three sub-periods; the 3 January 2001 – 31 June 2007 pre-crisis period, the 2 July 2007–31 December 2010 crisis period[18] and the 3 January 2011-31 December 2016 post-crisis period.

[13] Some Arab countries are not included in the study because they have volatile markets due to civil wars.
[14] Banking index for each Arab country is unavailable from databases such as Bloomberg or DataStream.
[15] Some Arab banks are state-owned banks, consequently, the paper ignores them due to the lack of public data availability.
[16] These are tradeable indices readily available to market participants; hence, the returns are a true reflection of the gains an investor could make by holding them in a portfolio.
[17] For each European country, the banking index is computed by weighted average market capitalization.
[18] We assign the July 2007 – December 2010 as crisis period because the majority of the events of global financial crisis and European sovereign debt crisis occurred during this time window consequently financial institutions in general and banks in particular capitalised significant losses during this period.

Measuring the copula dependence and granger causality network will require daily equity/index adjusted prices to include capital operations such as dividends and splits from Bloomberg's database. The sample includes 4165 average daily returns from each bank[19].

Summary statistics of each banking sector returns in the Arab region for the whole period are portrayed in Table 2. All Arab countries have returns ranging between -36.17% and 14.73% with a 0.03% daily average. Average positive returns are displayed by the elven Arab countries. Table 2 displays the average standard deviation to be estimated at 1.14% and is greater than average daily returns. Since standard deviation acts as a rough measure for risk, research reveals given returns, investors will face huge losses. Table 2 further substantiates this by showing distribution of returns being leptokurtic as 27.54 and -0.88 being the average kurtosis and average skewness respectively. Understanding kurtosis and skewness is vital as they influence managing risk, pricing of options, allocating assets and other activities in the financial market. Overall, investors tend to desire low kurtosis and low negative skewness categorised stocks (Kim and White 2004). High negative skewness is due to infrequent returns in preceding periods[20] and generally high turnover.

Table 2: Summary Statistics of Banking Sector Index Return (Overall Period)

	Mean	**STD Dev.**	**Min.**	**Max.**	**Skewness**	**Kurtosis**
Bahrain	0.01%	0.76%	-8.96%	8.76%	-0.58	15.22
Egypt	0.02%	1.66%	-36.17%	11.18%	-3.42	66.70
Jordan	0.04%	1.17%	-5.21%	5.05%	0.18	3.70
Kuwait	0.03%	1.09%	-11.62%	7.21%	-0.34	9.75
Lebanon	0.02%	0.93%	-22.89%	13.32%	-3.93	133.38
Morocco	0.04%	1.06%	-6.96%	6.47%	-0.08	4.29
Oman	0.03%	1.14%	-8.90%	8.10%	-0.40	12.02
Qatar	0.06%	1.52%	-14.22%	11.35%	-0.30	9.42
Saudi Arabia	0.02%	1.34%	-12.63%	11.52%	-0.56	12.27
Tunisia	0.02%	0.69%	-6.14%	5.26%	-0.29	7.93
UAE	0.04%	1.16%	-15.62%	14.73%	0.01	28.24
France	0.01%	2.22%	-18.17%	18.33%	0.06	7.76
Germany	-0.04%	2.27%	-15.93%	16.49%	-0.08	6.67
Italy	-0.03%	2.13%	-24.16%	15.93%	-0.38	7.95
Spain	-0.01%	2.00%	-20.04%	18.04%	-0.26	8.96
UK	-0.02%	2.05%	-27.68%	19.88%	-0.72	17.93
EU	0.00%	2.17%	-22.17%	19.79%	0.11	19.27
U.S.	0.01%	0.76%	-8.96%	8.76%	-0.58	15.22

For time-varying delta-CoVaR calculation, in addition to the daily equity adjusted prices, we need a set of lagged systematic state variables (M_{-1}) that act as controlling variables to remove variations in tail risk not directly connected to the financial system risk exposure[21]. While analysing the U.S., Eurozone and Arab region stock data under anecdotal observation with extensive data analysis, expected return can be sufficiently measured by simple time series factors. After conditioning these factors, adding other important factors will minimally contribute to the asset return's explanatory power[22]. Being sourced by macro-bond and

[19] Some banks are listed after 2000 and some data are not available after the Arab spring due to the civil wars that was initiated that results in shorter time series for some countries.

[20] The Jarque-Bera statistic strongly rejects the null hypothesis of normality in the return distributions which explains the massive losses during stress periods.

[21] Selection of these variables is guided by economic theory and evidence from previous studies on conditional mean predictability (Adrian and Brunnermeier 2011).

[22] This paper analyses quantitative data and the issues of qualitative data will neither be experienced nor be discussed here.

Bloomberg, the variables utilised are daily sampled. In quantile regressions, the relevant state variables used are displayed in table 3[23].

Table 3 reports the summary statistics of the daily market variables. Almost all extreme values of those variables occur during stress periods. It is also evident that the distributions of the variables are highly skewed. The spreads and spreads changes are expressed in basis points while the returns and volatility are expressed as a percentage points.

Table 3: European state variables.

State Variable	Europe
Volatility Index	European implied volatility index (V2X)
T-Bill spread variation	Difference between the 3-month Euro treasury bill rate in time t and the 3-month Euro treasury bill rate in time t-1
Yield spread change	Difference between the 10-year Euro bond rate and the 3-month Euro bond rate
Change credit spread	Difference between the 10-year Euro-bond BBB Eurozone corporate bond rate and the 10-year Euro bond rate
TED Spread	Difference between the UK 3-month LIBOR rate and the 3-month UK treasury bill rate
Equity return	The STOXX Europe 600 Index
Real-estate return	The EURO STOXX Real Estate Index

Table 4: EU Market Variables Summary Statistics

	Mean	STD Dev.	Min.	Max.	Skewness	Kurtosis
Volatility Index	24.99	9.65	11.60	87.51	1.62	3.24
T-Bill spread variation	-0.09	4.09	-117.70	85.50	-3.20	315.78
Yield spread change	135.52	75.34	-31.00	313.70	0.19	-0.61
Change credit spread	29.93	34.21	-2.00	277.43	3.38	13.89
TED Spread	0.02	10.78	-134.48	237.31	3.04	142.91
Equity return	0.00	1.25	-7.93	9.41	-0.17	5.44
Real-estate return	0.02	1.25	-8.64	8.78	-0.19	5.39

Notes: the spread and spread changes are expressed in basis points and the returns and volatility are expressed as a percentage.

Table 5 demonstrates the market volatility index ((V2X) has a positive and really relevant coefficient, meaning it has positively affected the expected VaR size. Therefore, greater VaR values are prompted by greater levels of volatility. Additionally, fluctuations in credit spreads and liquidity levels have overall been positive and are substantially linked with on a day-ahead VaR as bigger spreads form higher risk levels. Contrastingly, the financial institution's VaR have heterogeneously been affected by T-bill rate shifts and the STOXX Europe 600's market return. It has different signs but is not usually significantly different from zero individually. Lastly, VaR typically being lowered by a yield curve of a greater positive slope, shows that higher prospects of growth can be interpreted as lower levels of risk.

[23] The EU state variables are used in the context of Arab region for two main reasons. The first reason is that EU market is considered as global leader and most of its developments are followed by other markets. Moreover, it was the epicentre of the recent global financial crises and European sovereign debt crisis. The second reason is due to lack or inadequate indices for the Arab region as whole.

5 Analysis and Results

The quick pace of international economic and political changes will detrimentally affect different Arab economies as they are individually facing huge economic blocs. There is greater significance of Arab countries to financially and economically integrate to get by the continuously expanding international economic blocs[24]. The Arab countries has yet to provide huge powerful institutions to compete in the Arab or international banking platforms due to with many reasons, a lot being political. Financial integration has developed slower than trade integration in the Arab region. When compared to global standards, majority of the Arab economies' investment in global trade is not equal to their expansion in international finance. Against other emerging markets, cross-border banking in Arab economies is low and even lower in the euro area. Partially, the low level of financial integration can be attributable to capital restrictions which second-handedly hinder long term financial development.

Arab region's segmented banking markets has partially resulted in the industry's slow pace of development. Some Arab countries have strict regulations on the entry of foreign banks while simultaneously place constraints on the foreign banks' operations within their domestic banking market. Banks owned by the state have significant and at majority of times, superior market shares within the Arab region. Regardless of these momentous reforms, there are still barriers in a few important concerns. For example, a few countries obstruct dividend payments to shareholders and foreign investors' on remittances of profits. Constraints on borrowing from foreigners and loaning to non-residents still exist. The judicial system is greatly susceptible to political pressure due to its lack of independency, let alone the long delays. Creane et al. (2007) states this has resulted in contracts being weakly enforced on a legal basis and poor loan recovery rates in the event of defaults.

Arab economies mainly depend on banks to supply sufficient credit[25]. The most vital kinds of Arab region financial institutions are commercial banks. They are primarily regulated and overseen by the central bank while various regulatory agencies regulate nonbank financial institutions and special-purpose banks. Excluding insurance companies, non-bank and capital market-related financial institutions have only started developing with limited intermediation capacity. In Arab countries, the only kind of nonbank financial institution frequently seen is insurance companies and their primary business activities vary with each country. Integrating the Arab banking market demands a significant level of regulatory harmonisation from member states. However, it is deterring to establish uniform regulatory structure in a region of numerous sovereign states progressing at different developments levels as it violates national sovereignty.

GCC presents higher degree of economic integration among the Arab region. GCC countries have seek for economic and financial integration despite some restrictions existing within the financial account since 1981.[26] With numerous macroeconomic indicators displaying convergence, the GCC countries pursued monetary union via forming the Monetary Council in 2009, a predecessor to the typical central bank[27]. Ordinary shocks are common in the GCC due

[24] International economic blocs such as European Union (EU), North America Free Trade Area (NAFTA), Asia-Pacific Economic Cooperation (APEC), Association of Southeast Asian Nations (ASEAN), and Brazil, Russia, India, China and South Africa (BRICS).

[25] This is similar to EU members but different in U.S. where markets and non-bank financial institutions predominate.

[26] These include restrictions on residents opening accounts abroad and restrictions on investments in local equity and real estate markets.

[27] The GCC economies share a number of common features. These economies are characterized by large oil producing sectors, dependency on oil exports, stable currencies and stable price levels. Similarities also extend to geography, longstanding cultural and political ties, a common language, high living standards and coordinated policies. These similarities by far outweigh any differences.

to their countries' economic structure being similar (preponderance of the hydrocarbon sector, reliance on imported labour, peg to the dollar or to a basket including the dollar). The GCC are systemically fundamental; they possess 40% and 23% of the world's proven oil and gas reserves respectively; their sovereign wealth funds (SWFs) are valued over US$ 1 trillion and their equity market's market capitalisation (US$ 1 trillion) is roughly half of Hong Kong's during their peak. Being a G-20 member, Saudi Arabia has the largest economy. However, commercial banks still control the GCC's financial systems, thus impedes the cross-border equity flows' importance.

In 2015, all Arab commercial banks had an average capital adequacy ratio higher than 16% while their averaging nonperforming loan ratio in majority of Arab countries was below 5%. These ratios indicate that most banks in the Arab region averagely satisfy international safety and soundness standards. In terms of asset size, banks in the Arab region and different financial institutions are too small to effectively challenge global competitors in international financial markets. As some Arab financial market are characterised to be small-scaled, divided and illiquid, they are exposed to shocks external to the region. However, tightly regulating a few cross-border financial transactions has slowed down financial integration in the Arab region.

The GCC's banking market is generally concentrated with some major banks while the other banks operate on a scaled down level. The GCC countries' banking industry is considered generally new since the oldest banks do not date back further than 1950. The public sector's role is still important despite most being owned privately. Through multiple banks involved in equity participation or a few specialised credit institutions owned by the government that provide financing at subsidised rates to enterprises in both public and private sectors, the public sector is still significant in the GCC countries' banking industry. Privatised financial institutions tends to focus on a minority of shareholders; a concern that lowers both benefits and risks of corporate control by the market[28]. Shaffer (1994) has officially linked the higher chances of systemic risk related to concentrated markets. The perspective on the connection between market structure and competition is derived from the traditional monopoly power hypothesis. It argues that more concentrated markets have a tendency for greater collusion and by working with broader intermediation margin, banks can earn monopolistic profits.

[28] The concern of natural policy is how non-competitive pricing generating welfare loss could potentially outweigh any assumed benefit correlated with mergers or with the presences of large institutions. Other economic matters concerning concentrated markets also include the central bank policy's effectiveness, the higher chance of systemic risk and potential cutback of lending to small and medium firms.

Table 5: Linear Correlation among Arab countries, EU and U.S. (Whole Period)

	U.S.	EU	UK	Germany	France	Spain	Italy	Egypt	Bahrain	Jordan	Kuwait	Lebanon	Morocco	Oman	Qatar	S. Arabia	Tunisia
EU	0.4337																
France	0.3942	0.9026															
Germany	0.4793	0.8194	0.6519														
Italy	0.3591	0.864	0.7191	0.7312													
Spain	0.3712	0.8758	0.6544	0.6879	0.7416												
UK	0.4091	0.7648	0.6251	0.6756	0.7492	0.7207											
Bahrain	-0.0133	0.0043	0.0067	0.0110	-0.0047	-0.0099	0.0081										
Egypt	-0.0164	0.0003	-0.0120	0.0105	0.0029	-0.0074	0.0008	0.0534									
Jordan	0.0308	0.0016	-0.0039	0.0181	0.0057	-0.0090	-0.0030	0.0283	0.0430								
Kuwait	0.0657	0.0158	0.0119	0.0338	0.0119	0.0165	0.0148	0.0267	0.0091	0.0355							
Lebanon	-0.0109	-0.0094	0.0418	-0.0106	-0.0186	-0.0112	-0.0014	0.0034	0.0120	-0.0020	0.0088						
Morocco	0.0433	0.215	0.1404	0.1914	0.1864	0.1833	0.1939	0.0445	0.0323	0.0092	0.0378	0.0169					
Oman	0.0309	0.0179	0.0248	0.0254	0.0149	0.0123	0.0181	0.0764	0.0928	0.0528	0.0577	-0.0016	0.0014				
Qatar	0.047	0.0159	0.0224	0.0466	0.0022	0.0083	0.0161	0.1137	0.0969	0.1179	0.0449	0.0169	0.0337	0.2332			
S. Arabia	-0.0414	-0.0098	-0.0091	-0.0161	0.0007	-0.0220	-0.0110	0.0401	0.0628	0.0202	0.0310	0.0058	-0.0093	0.0471	0.0316		
Tunisia	0.0169	0.2	0.1281	0.1683	0.1648	0.1904	0.1879	0.0478	0.0154	0.0058	-0.0230	0.0024	0.1957	0.0048	0.0138	-0.0018	
UAE	0.006	0.0146	0.0292	0.0130	0.0121	0.0103	0.0183	0.0721	0.0589	0.0628	0.0292	0.0323	-0.0093	0.1404	0.2060	0.0402	0.0114

Table 5 shows linear correlation among the eleven Arab banking sectors, EU, U.S., and five European member states (UK, Germany, France, Spain and Italy). Of importance is the correlation between the U.S. and Europe while there is weak and negative correlation between the U.S. and the Arab region. The ranking for the U.S.-related pairs from lowest to highest is U.S.-Saudi Arabia, U.S.-Egypt, U.S.-Bahrain and U.S.-Lebanon which has a negative correlation. Similarly, the linear correlation from lowest to highest for the EU-related pairs is EU-Saudi Arabia, EU-Lebanon, which has a negative correlation and the weakest correlation is for EU-Egypt and EU-Jordon. Correlation is generally low among the U.S., EU and Arab pairs. At the surface, the low correlation seems to be an indication of the possible benefits from diversification. However, it is instructive to note that the correlation coefficient only tell us about the average dependence over the entire distribution, thus, it would be misleading if one uses it to make inferences about diversification opportunities. Besides other shortcomings, correlation is a linear measure and is unable to capture the nonlinear dependence among the markets, hence the need for the copula technique, which is more robust.

Table 6: Estimates of time-varying Gaussian copulas: US-related Pairs.

Country	Ψ	Ψ_1	Ψ_2	AIC
Bahrain	0.0491 (0.0316)	0.0086 (0.0113)	0.4516 (0.5479)	2.9559
Egypt	0.0030	0.0498	0.9933	
Jordan	0.0250	0.0196	0.0000	3.8527
Kuwait	0.0410	0.0000	0.0000	4.2586
Lebanon	-0.0133 (0.0367)	0.0043 (0.0043)	0.9756 (0.0365)	4.5154
Morocco	0.0946	0.0000	0.0000	-3.2638
Oman	0.0492 (0.0573)	0.0064 (0.0028)	0.9927 (0.0060)	-7.8611
Qatar	0.0715 (0.0609)	0.0017 (0.0011)	0.9981 (0.0024)	-4.9386
Saudi Arabia	0.2014 (0.1073)	0.0038 (0.0016)	0.9989 (0.0014)	-63.4903
Tunisia	0.0404 (0.0384)	0.0026 (0.0029)	0.9890 (0.0260)	2.5894
UAE	0.1215 (0.0852)	0.0031 (0.0016)	0.9986 (0.0019)	-26.1106
France	0.5528 (0.1342)	0.0023 (0.0011)	1.0000 (0.0000)	-170.0622
Germany	0.2642 (0.0932)	0.0029 (0.0014)	0.9984 (0.0024)	-58.3238
Italy	0.3118 (0.1204)	0.0033 (0.0013)	0.9990 (0.0017)	-88.8116
Spain	0.3328 (0.1086)	0.0026 (0.0012)	0.9993 (0.0013)	-109.4662
UK	0.3984 (0.0576)	0.0015 (0.0010)	0.9987 (0.0020)	-161.8180

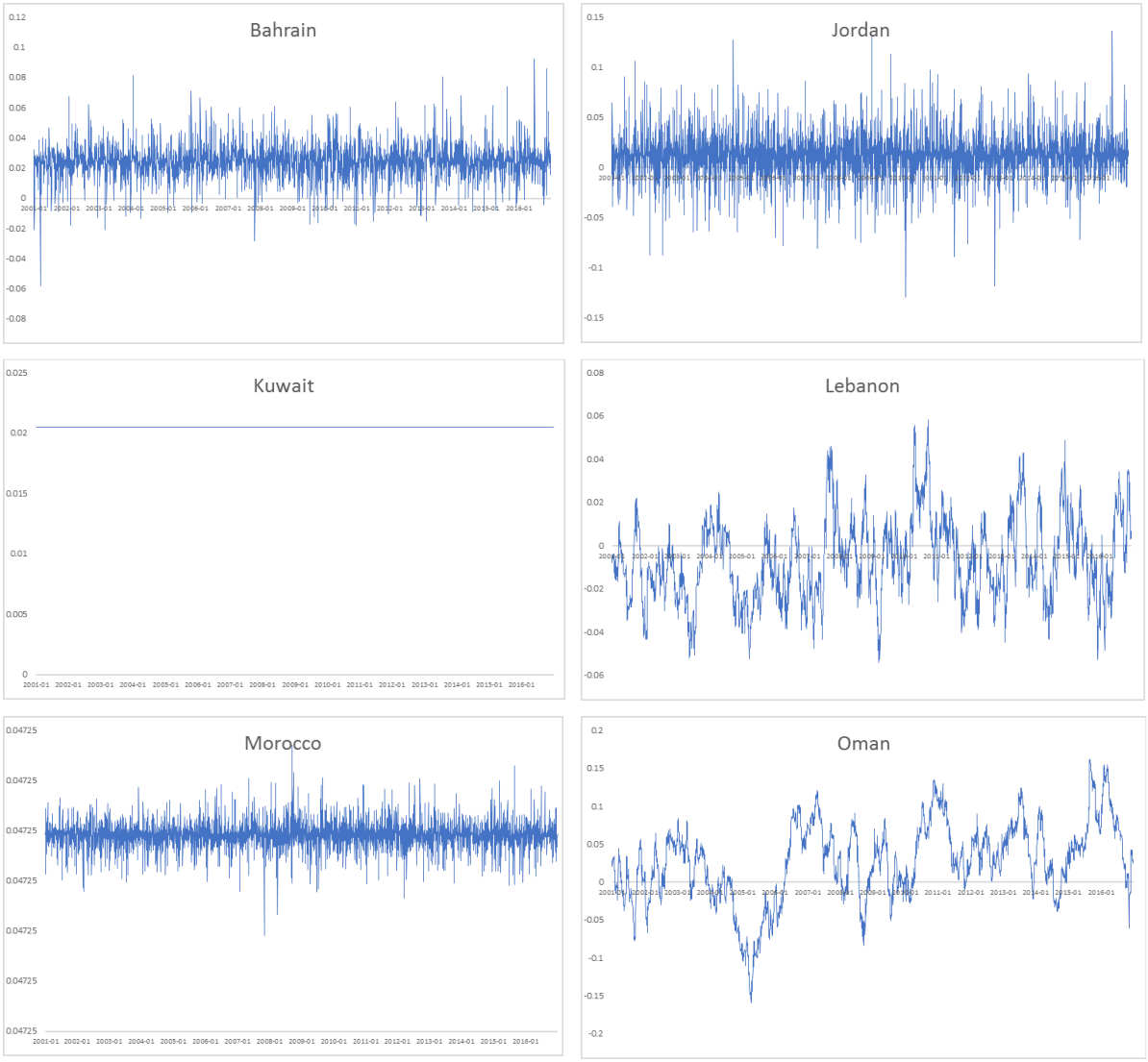
Notes: the table reports the estimates of time-varying Gaussian copulas of US-related pairs with Arab and European banking sectors. Standard errors are given in parenthesis.

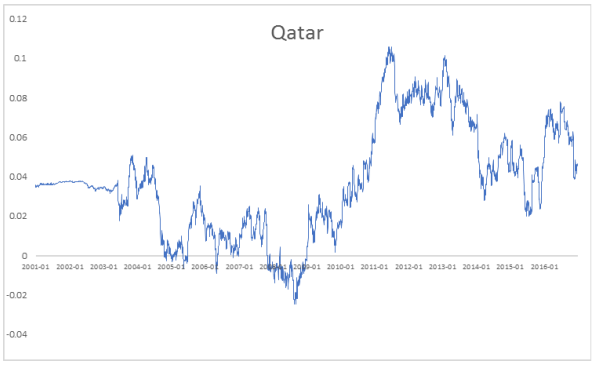
Table 6 displays estimates of the time varying copula dependence of U.S. related pairs with Arab and European banking sectors. As the Gaussian copula parameter estimates reveal the markets' dependences, we can conclude that there is a weak dependence between the USA and Arab banking sectors. The dependence estimates are statistically significant for the majority of Arab banking sectors. It is obvious that the dependence between the USA and European banking sectors is higher than the dependence between the USA and Arab banking sectors.

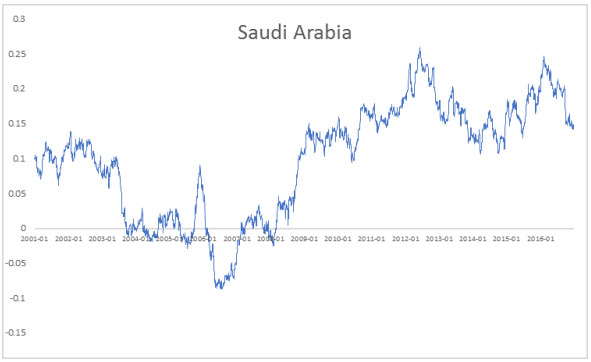
Moreover, the time-varying Gaussian copula parameters both show the existence of time-varying dependence between the banking sectors.

Figure 2 depicts the temporal evolution based on the Gaussian copula GAS specification between the USA and Arab banking sectors as well as the USA and European banking sectors. Obviously, there is no similarity in the temporal evolution of dependence for the bivariate relationships. An upward trend can be found for the USA pair with all European countries in the study till the 2007 global financial crisis and 2009 European sovereign debt crisis followed by a down trend afterwards. Lebanon, Oman, Qatar, Saudi Arabia, Tunisia and UAE show significant peaks coinciding with both or either the subprime and debt crisis. Bahrain, Jordon and Morocco shows mild clustering. We can conclude that Arab banking sectors do not respond uniformly to the USA banking sector while European banking sectors respond expressively to the USA banking sector.

Figure 2: Time-varying Gaussian Dependence of the USA with Arab and European Banking Sectors




Qatar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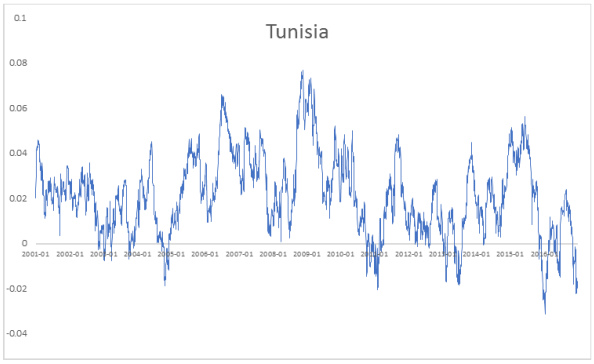
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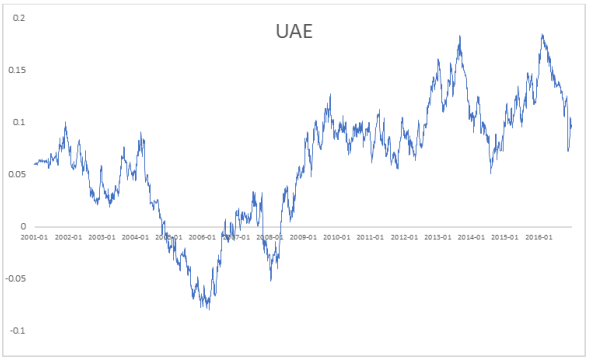
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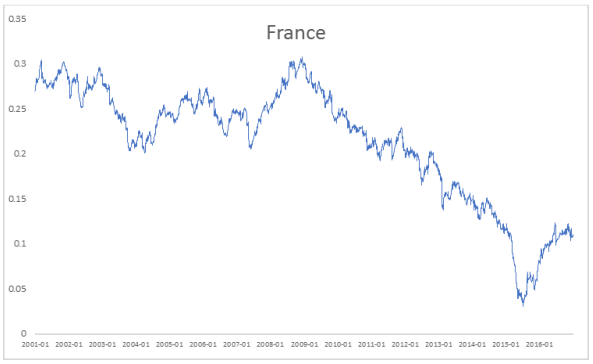
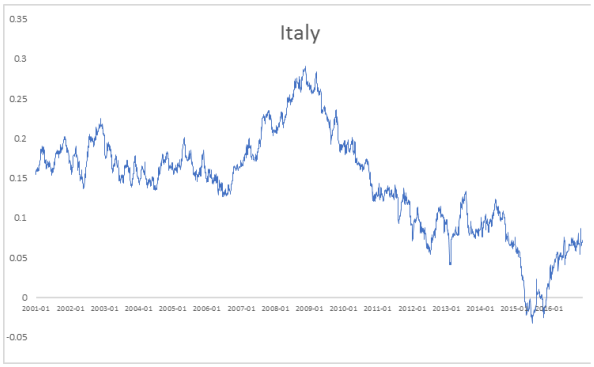

France


Germany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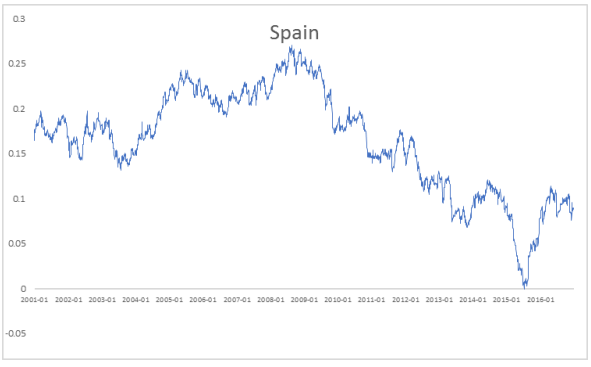
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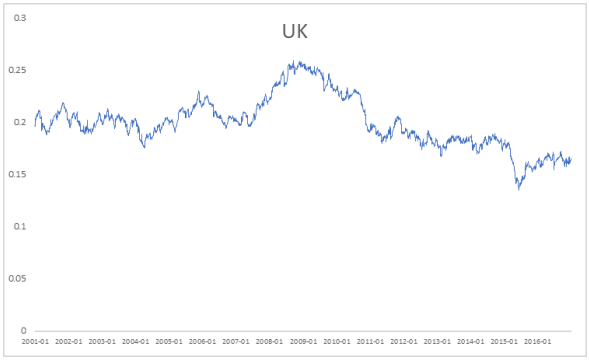

Notes: The figure displays the evolution of time-varying Gaussian dependence of the USA banking sector with Arab and European Banking Sectors for the period (2001-2016).

Table 7 depicts the time-varying delta CoVaR estimated at 5% significance level over the full period, pre-crisis period, crisis period during which the worst crisis ever experienced after the great depression of 1930s hit the global financial market, and post-crisis period. The systemic contributions of the banking sectors have been ranked in descending. Large ΔCoVaR values (in absolute value) imply high systemic risk contribution and vice versa. The ΔCoVaR values span from -0.0125 for Germany, through -0.0004, for Lebanon for the whole period. The wide variation in the numbers indicates the unique contribution by each banking sector to riskiness of the financial system; that is, some banking sectors contribute more, others are mild in their contribution while a few other banking sectors rather move in the opposite direction to make the financial system stable. European banking sectors contribute mainly to the systemic risk while in average the Arab countries contribute less to systemic risk with the exception of only Saudi Arabia and Qatar that have the higher systemic risk contribution among all Arab countries. This is attributed to the fact that banks in developed markets (EU) mostly deal in complex financial instruments and risky activities, some of which end up being toxic securitisation and derivative assets such as MDSs, CDOs, and derivative securities that are likely to hamper the health of the financial system.

Table 7: Average Time–variant $\Delta CoVaR_q^{sys|i}$QR for Each Banking Sector

Country	Overall	
	Rank	$CoVaR_q^{sys|i}$
Bahrain	12	-0.0011
Egypt	14	-0.0008
Jordan	15	-0.0007
Kuwait	11	-0.0015
Lebanon	16	-0.0004
Morocco	13	-0.0010
Oman	10	-0.0016
Qatar	8	-0.0021
Saudi Arabia	7	-0.0023
Tunisia	9	-0.0017
UAE	6	-0.0024
France	5	-0.0040
Germany	1	-0.0125
Italy	4	-0.0075
Spain	2	-0.0115
UK	3	-0.0087

We apply Granger-causality test over the whole sample period (2000-2015). The 36-month rolling window estimate, hovers around 0.07 – 0.15 in the pre-crisis sample, and rises to around 0.21 during the 2007 global financial crisis. The dynamic causality index provides useful information on the interconnectedness of the banking sectors in the Arab region, EU and U.S. It shows that the degree connectedness of the banking sectors in the Arab region vary considerably through time and become highly interconnected during periods of systemic shocks. For instance, the DCI showed an upward trend from the pre-crisis sample, peaking at 0.15 in the third quarter of 2001 during the Terrorist attacks on September 2001, and subsequently declined[29]. The DCI continues with local peaks and troughs and stays high in the fourth quarter of 2007 (the beginning of the subprime crisis)[30], declining sharply afterwards and reaches its highest peak in the second quarter of 2009 due to the European sovereign debt crisis[31].

In addition, we show the network diagram of linear Granger causality relationships that are statistically significant at the 5% level, estimated during sample period considered, among the daily returns of the 19 banking sectors of the Arab region, EU members and U.S. The Granger causality relationships are estimated including autoregressive terms and filtering out heteroskedasticity with a GARCH(1,1) model. The curved lines connecting the institutions represent the Granger-causality relationships, that is, the banking sector at date-t which Granger-causes the returns of another banking sector at date t+1.

The network diagrams presented in Figures 1 shows that the number of connections among the banking sectors has increased since the early 2000. The full sample estimation shows 127 connections. The Figures also indicate that the Arab banking sector becomes densely connected during crisis period in comparison to more tranquil periods. For instance, the total number of connections among the banking sectors in the pre-crisis period was 113 but it becomes highly interconnected during the crisis period of 149 connections.

Network diagram of linear Granger causality relationships that are statistically significant at the 5% level among the daily returns of the 19 banking sectors of the Arab region, EU members and U.S. over January 2000 to December 2015. Granger causality relationships are estimated including autoregressive terms and filtering out heteroskedasticity with a GARCH(1,1) model. There are 127 significant Granger-causal relations over the whole sample period.

[29] The terrorist attack on the World Trade Centre had a huge impact on the Global financial system. It caused a disruption of the interbank payment system which then led to difficulties in payment instructions for banks (Bartram, Brown, and Hund, 2007; Weiß, Bostandzic, and Neumann, 2014).

[30] The failure of the oldest investment bank (Lehman Brothers) in the U.S. on September 15, 2008 led to great uncertainty and escalated the crisis and contagion effect.

[31] The severe debt crisis in Portugal, Ireland, Italy, Greece, and Spain (PIIGS) as well as the adoption of austerity measures in EU.

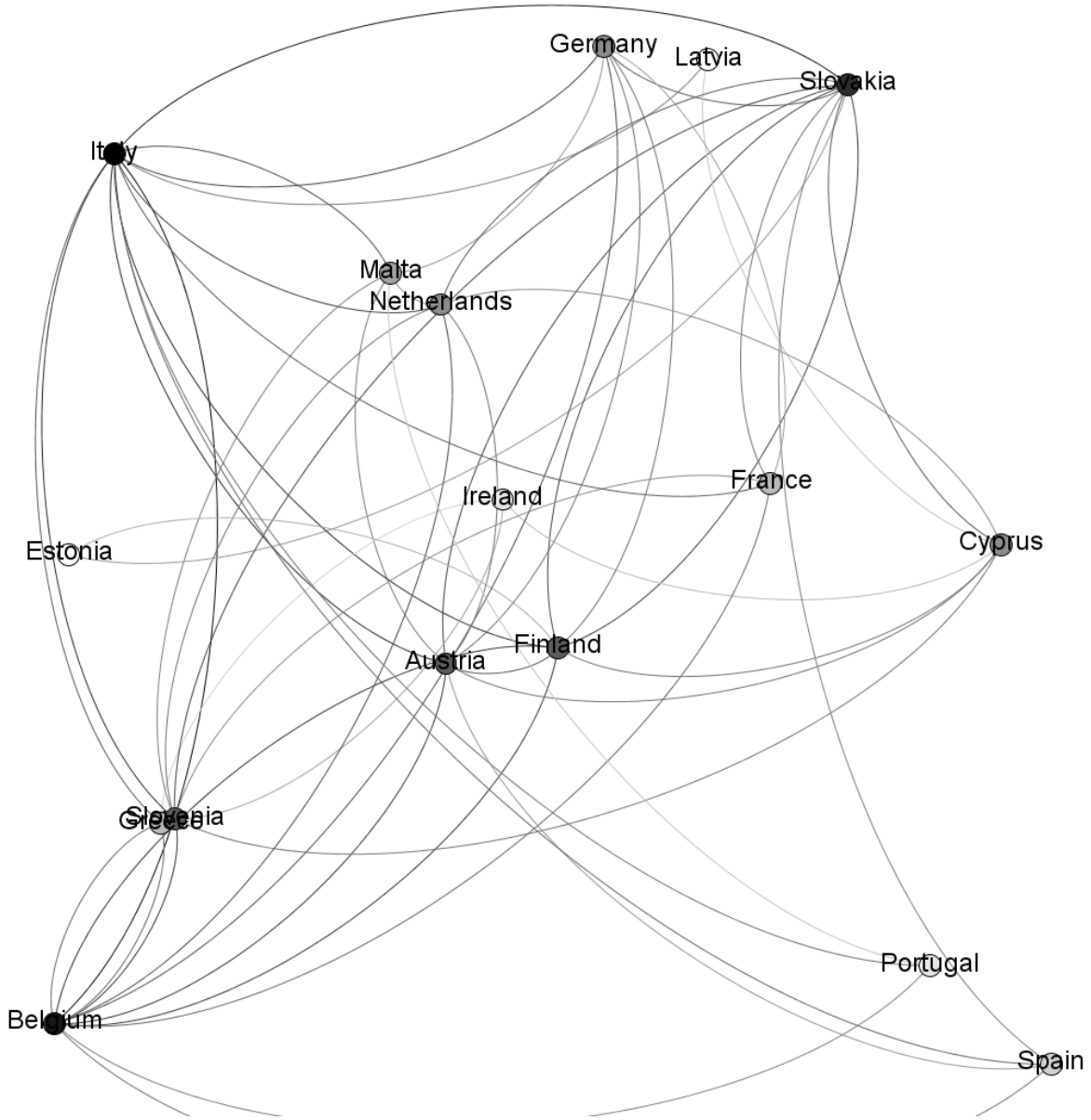

Figure 1: Banking Sectors Network Diagram of Linear Granger Causality Relations (Overall Period)

In addition, we present the number of institutions that each banking sector Granger causes at 5% as well as the percentage of the total number for the whole period. The results in table 8 suggests that some banking sectors have high degree of connectedness including U.S. (11 significant connections), Germany (11 significant connections), Spain (11 significant connections), Qatar (11 significant connections), UK (10 significant connections), Oman (10 significant connections), Italy (8 significant connections), and EU (8 significant connections). While other banking sectors have low degree of connectedness including Jordan (3 significant connections), Kuwait (3 significant connections), and few Arab banking sectors have no significant degree of connectedness including Lebanon (0 significant connections) and Saudi Arabia (0 significant connections).

Arab region was not the origin of the 2007 global financial crisis nor the 2009 European sovereign debt crisis, and indeed, the crisis had a less-damaging effect on Arab's banking sectors compared to EU and the US. Yet, the findings from the Granger-causal relations suggest that banking sectors in the Arab region became more connected during the crisis. Even though

the number of Granger-causal relations has reduced slightly after the 2007 global financial crisis, it is still high compared to the pre- crisis period. This high interconnection between the banking sectors is indicative of potential systemic risk in the Arab region.

In summary, by measuring Granger-causality-network connections among banking sectors, we find that, the some Arab banking sectors has become more interconnected over the past decade, increasing the potential for systemic events. Given the wealth of evidence that globally, correlation among financial markets has been increasing, this is not overly surprising, but it provides the motivation for considering mitigating measures.

Table 8: Number of connections from each banking sector at 5% level (Overall Period)

Banking Sector	No. of connections	% of total
Bahrain	5	3.94%
Egypt	5	3.94%
Jordan	3	2.36%
Kuwait	3	2.36%
Lebanon	0	0.00%
Morocco	7	5.51%
Oman	10	7.87%
Qatar	11	8.66%
Saudi Arabia	0	0.00%
Tunisia	6	4.72%
UAE	6	4.72%
GCC	5	3.94%
France	7	5.51%
Germany	11	8.66%
Italy	8	6.30%
Spain	11	8.66%
UK	10	7.87%
EU	8	6.30%
U.S.	11	8.66%

6 Conclusion and Regulatory Policy Implications

This paper draws significant relationships between systemic risk contribution using time varying delta CoVaR and the degree of dependence using time varying Gaussian copula dependence and the number of networks using the granger causality network analysis. The paper concludes that European banking sectors has a high degree of copula dependence with the USA banking sector while the majority of Arab banking sectors display weak dependence. This is evident by the number of granger causality networks that is higher for European banking sectors compared to Arab banking sectors. Consequently, European banking sectors contribute more to systemic risk rather than Arab banking sectors as evident from $\Delta CoVaR$.

Countries in the Arab region must develop banks to be internationally competitive. By integrating Arab banking institutions, this will form the environment to introduce banks of such standards. This will generate a large customer base that is sufficient in nurturing the development of huge competing banks that have a stand in global banking via merging and acquiring small banks. Integrating the national banking sector is crucial to gaining monetary union. Harald and Kleimeier (2004) state that the strength of banks is imperative to establish an effective monetary policy as they are significant policy conveyors. In addition, integration will transform policies across different Arab countries to become similar and homogenous natured and thus strengthening financial and economic stability.

Arab-based banks in the Arab region have slowly progress in regards of cross-border banking and cross-border penetration. Arab banks must create financial resources and managerial capacity, satisfy international standards and obtain similar levels of regional penetration to efficiently compete. Liberalisation itself cannot attain the expected banking integration result as a few bank in the Arab region are a bit behind on national regulatory standards against foreign banks. Progress of individual countries rely on their keenness regarding the quality of both their financial practise standards and financial market infrastructure, quality of their financial infrastructure and institutional capability to initiate reforms. Last of all, the gap amongst countries in the Arab region must be reduced over time. Financially integrating the Arab area would occur at varying paces to construct infrastructure for the regional financial market while harmonising institutions, policies, market practises to ultimately build the groundwork for regional financial integration.

Multi-national, multi-product financial corporations which are quickly expanding across Arab countries are highly probable in being key cross-border systemic risk transmitters. Without devoted and harmonised coordination from the necessary authorities, regulating and supervising the financial conglomerates will be challenging. These issues' difficulties emphasise the importance of discussing about regional financial cooperation in regards of providing liquidity and protecting liquidity sources from risk as well as cross-border regulation and supervision. How these issues are handled is significant to guarantee everlasting strength of the financial systems, of both national and regional levels, as a whole[32].

It is significant that a high degree of banking integration leads to higher systemic risk contribution which leads to financial instability and financial fragility as banks become more too-interconnected-to-fail. In addition, Arab banking sectors are characterised by high concentration ratio which escalates systemic risk contribution because banks are too-big-to-fail. Policy makers must create a sustainable framework for efficiently supervising and regulating cross-border banks under the current rate of banking integration. Therefore, financial integration benefits must be compared to the cost of higher financial fragility. The ability to

[32] The required measures to typical supervisory approaches, sharing information and cooperating during crises. Attempting to gain integration benefits without responsibilities would result in disastrous repercussions.

govern and supervise multi-national banks, the transfer of systemic risk amongst borders and the range of liquidity relief provided for a temporal capital crunch by banking integration must be included within these policy issues.

While acknowledging different economic and social backgrounds, a highly planned and arranged process of integration should enable member states to continually manage financial sector progress along with financial and socioeconomic stability. Each country is therefore required to adopt the principles listed:

1. Countries that are already prepared to financially liberalised can do so first before later being joined by others;
2. Member states' discrepancies in their pace of economic and financial sector development and their national policy objectives must be respected;
3. Ease of member states preparing their own prerequisites to liberalise and forming their own timelines;
4. Acceptance of financial regulation's internationally recognised standards;
5. Using sufficient safeguards against macroeconomic instability and systemic risk which could result from the process of liberalising and involves the authority to support each country's regulatory discretion of national authorities to take mandatory action.

As greater regional integration occurs in the Arab region, it is fundamental for policy makers to understand the implications of banking integration place on systemic risk. The detrimental consequences of the recent global financial crisis have alerted policy makers and regulators to concentrate on maintaining the financial system's stability as well as the general role of financial integration and the banking integration that specifically behaves as a passage for systemic risk. Incorporating safeguards to an integrated financial sector to strengthen regional economic integration while propelling regional economic growth can contribute to Arab economic integration. Systemic application of financial sector liberalisation and capital account liberalisation, assisted by Arab-wide regulatory measures such as instruments for crisis prevention, management, resolution and Arab-linked payment can promote Arab-wide financial integration.

Many lessons from the global financial crisis underline the significance of generating close cooperation between banking supervisors from different borders. Co-movement of bank risk arises from vulnerability to common shocks that may derive from varying sources. Being tied to typical macroeconomic shocks, they may potentially come from the usual risks to industries, individual counterparts, countries along with interbank linkages (Upper and Worms 2002; Gropp and Vesala 2004).

Integration should not be condemned as the financial industry requires a business model of less risk along with improved regulations, overseeing and transparency. The banking sector's equity capital and the reserve may not be sufficient during a banking crisis while government rescue could imperil the state budget. There is an urgency for an arranged cross-border supervision and surveillance along with a stronger regional financial safety net to enhance the regional institutions resilience in operating as a last resort lender.

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Appendix A: Bloomberg Dataset Tickers

#	Country	Ticker
1	Bahrain	AUB BI Equity
2	Bahrain	GFH BI Equity
3	Bahrain	NBB BI Equity
4	Bahrain	BARKA BI Equity
5	Bahrain	ITHMR BI Equity
6	Bahrain	BBK BI Equity
7	Bahrain	UGB BI Equity
8	Bahrain	SALAM BI Equity
9	Bahrain	BISB BI Equity
10	Bahrain	KHCB BI Equity
11	Bahrain	ABC BI Equity
12	Bahrain	BMB BI Equity
13	Bahrain	TAIB BI Equity
14	Egypt	COMI EY Equity
15	Egypt	QNBA EY Equity
16	Egypt	CIEB EY Equity
17	Egypt	FAIT EY Equity
18	Egypt	HDBK EY Equity
19	Egypt	NBKE EY Equity
20	Egypt	SAUD EY Equity
21	Egypt	ADIB EY Equity
22	Egypt	UNBE EY Equity
23	Egypt	CANA EY Equity
24	Egypt	EGBE EY Equity
25	Egypt	SAIB EY Equity
26	Jordan	ARBK JR Equity
27	Jordan	THBK JR Equity
28	Jordan	JOIB JR Equity
29	Jordan	BOJX JR Equity
30	Jordan	JOKB JR Equity
31	Jordan	CABK JR Equity
32	Jordan	UBSI JR Equity
33	Jordan	AHLI JR Equity
34	Jordan	EXFB JR Equity
35	Jordan	JCBK JR Equity
36	Jordan	ABCO JR Equity
37	Kuwait	NBK KK Equity
38	Kuwait	KFIN KK Equity
39	Kuwait	BOUBYAN KK Equity
40	Kuwait	GBK KK Equity
41	Kuwait	ALMUTAHE KK Equity
42	Kuwait	BURG KK Equity
43	Kuwait	CBK KK Equity
44	Kuwait	ABK KK Equity
45	Kuwait	WARBABAN KK Equity
46	Kuwait	KIB KK Equity
47	Lebanon	AUDI LB Equity
48	Lebanon	BLOM LB Equity
49	Lebanon	BOB LB Equity
50	Lebanon	BYB LB Equity
51	Lebanon	BLC LB Equity
52	Lebanon	BEMO LB Equity
53	Morocco	ATW MC Equity
54	Morocco	BCP MC Equity
55	Morocco	BCE MC Equity

56	Morocco	BCI MC Equity
57	Morocco	CIH MC Equity
58	Morocco	CDM MC Equity
59	Oman	BKMB OM Equity
60	Oman	BKDB OM Equity
61	Oman	NBOB OM Equity
62	Oman	BKSB OM Equity
63	Oman	HBMO OM Equity
64	Oman	BKNZ OM Equity
65	Oman	BKIZ OM Equity
66	Qatar	QNBK QD Equity
67	Qatar	MARK QD Equity
68	Qatar	QIBK QD Equity
69	Qatar	CBQK QD Equity
70	Qatar	QIIK QD Equity
71	Qatar	DHBK QD Equity
72	Qatar	ABQK QD Equity
73	Qatar	KCBK QD Equity
74	Qatar	QFBQ QD Equity
75	Saudi Arabia	RJHI AB Equity
76	Saudi Arabia	NCB AB Equity
77	Saudi Arabia	SAMBA AB Equity
78	Saudi Arabia	SABB AB Equity
79	Saudi Arabia	RIBL AB Equity
80	Saudi Arabia	BSFR AB Equity
81	Saudi Arabia	ALINMA AB Equity
82	Saudi Arabia	ARNB AB Equity
83	Saudi Arabia	AAAL AB Equity
84	Saudi Arabia	ALBI AB Equity
85	Saudi Arabia	SIBC AB Equity
86	Saudi Arabia	BJAZ AB Equity
87	Tunisia	BIAT TU Equity
88	Tunisia	BT TU Equity
89	Tunisia	TJARI TU Equity
90	Tunisia	STB TU Equity
91	Tunisia	AB TU Equity
92	Tunisia	UIB TU Equity
93	Tunisia	UBCI TU Equity
94	Tunisia	BH TU Equity
95	Tunisia	ATB TU Equity
96	Tunisia	BNA TU Equity
97	Tunisia	BTE TU Equity
98	UAE	FGB UH Equity
99	UAE	NBAD UH Equity
100	UAE	EMIRATES UH Equity
101	UAE	ADCB UH Equity
102	UAE	DIB UH Equity
103	UAE	CBD UH Equity
104	UAE	MASQ UH Equity
105	UAE	UNB UH Equity
106	UAE	ADIB UH Equity
107	UAE	RAKBANK UH Equity
108	UAE	NBF UH Equity
109	UAE	EIB UH Equity
110	UAE	NBQ UH Equity
111	UAE	NBS UH Equity
112	UAE	INVESTB UH Equity
113	UAE	CBI UH Equity

114	UAE	BOS UH Equity
115	UAE	UAB UH Equity
116	UAE	AJMANBAN UH Equity
117	UK	HSBA LN Equity
118	UK	LLOY LN Equity
119	UK	BARC LN Equity
120	UK	RBS LN Equity
121	UK	STAN LN Equity
122	UK	CYBG LN Equity
123	UK	MTRO LN Equity
124	UK	TCS LI Equity
125	UK	VM/ LN Equity
126	UK	BGEO LN Equity
127	UK	ALD LN Equity
128	UK	TBCG LN Equity
129	UK	SHAW LN Equity
130	UK	STB LN Equity
131	UK	CIHL LN Equity
132	Germany	DBK GR Equity
133	Germany	CBK GR Equity
134	Germany	PBB GR Equity
135	Germany	OLB GR Equity
136	Germany	UBK GR Equity
137	Germany	IKB GR Equity
138	Germany	QB7 GR Equity
139	Germany	MBK GR Equity
140	Germany	AW2 GR Equity
141	France	BNP FP Equity
142	France	GLE FP Equity
143	France	ACA FP Equity
144	France	KN FP Equity
145	France	CC FP Equity
146	France	CAF FP Equity
147	France	CRLA FP Equity
148	France	CNF FP Equity
149	France	CRAV FP Equity
150	France	CRSU FP Equity
151	France	CCN FP Equity
152	France	CRAP FP Equity
153	France	MLCFM FP Equity
154	France	CRLO FP Equity
155	France	CRTO FP Equity
156	France	CAT31 FP Equity
157	France	CIV FP Equity
158	France	CMO FP Equity
159	Spain	SAN SM Equity
160	Spain	BBVA SM Equity
161	Spain	CABK SM Equity
162	Spain	BKIA SM Equity
163	Spain	SAB SM Equity
164	Spain	BKT SM Equity
165	Spain	POP SM Equity
166	Spain	LBK SM Equity
167	Spain	CAM SM Equity
168	Italy	ISP IM Equity
169	Italy	UCG IM Equity
170	Italy	MB IM Equity
171	Italy	FBK IM Equity

172	Italy	UBI IM Equity
173	Italy	BPE IM Equity
174	Italy	BP IM Equity
175	Italy	CE IM Equity
176	Italy	PMI IM Equity
177	Italy	BPSO IM Equity
178	Italy	BMPS IM Equity
179	Italy	CVAL IM Equity
180	Italy	BSRP IM Equity
181	Italy	CRG IM Equity
182	Italy	BDB IM Equity
183	Italy	BFE IM Equity
184	Italy	PRO IM Equity
185	Italy	PEL IM Equity
186	Italy	SPO IM Equity